A Comprehensive Guide to

CLEARWATER 2001

Tucson's New Blended Water Resource

What It Means To Our Future

TUCSON WATER

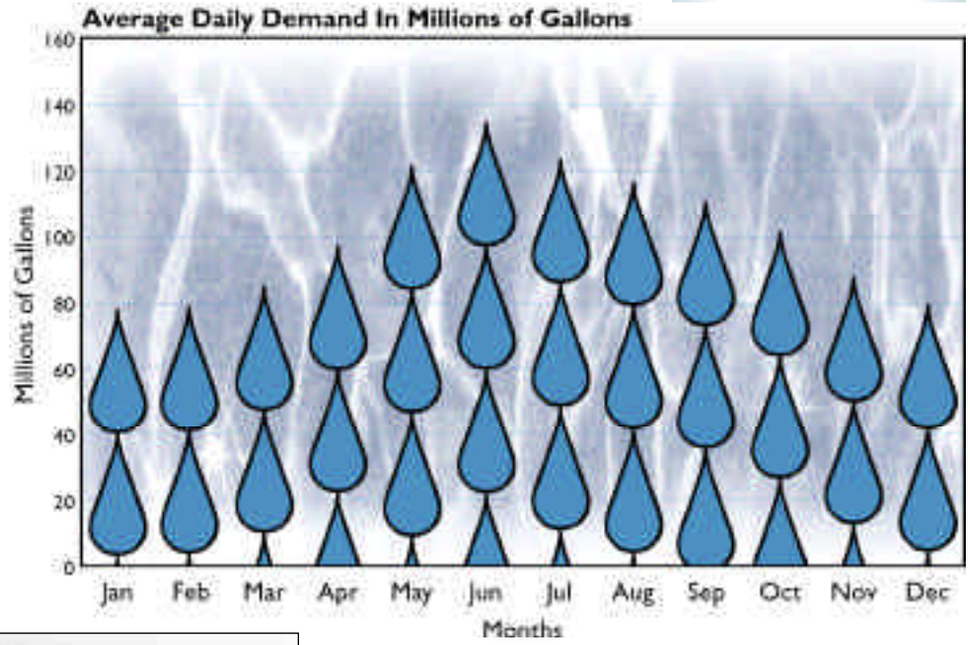
The Future is Crystal Clear

A New Water Resource for Tucson

The Clearwater Renewable Resource Facility has been called the largest and most critical construction project Tucson has seen in more than a decade. Clearwater is being built by Tucson Water in Avra Valley, west of the City. It supplies a major portion of Tucson's future water supply, allowing us to reduce groundwater pumping in the central city.

In the spring of 2001, Tucson Water began adding about 18 million gallons of water a day from Clearwater to our water distribution system. While this is only a part of the water Tucson Water customers use each day, it's the beginning of our use of a renewable water supply. In the coming years, Tucson Water will be expanding the Clearwater Facility to increase the amount of blended water available to us, until it ultimately supplies about half of the water we use each day. It will help supply the water needs of Tucson for many years and gives us a reliable source of quality water for the future.

Average Daily Water Use by Tucson Water Customers



The Clearwater Facility will supply about 53% of Tucson's water needs by 2004.

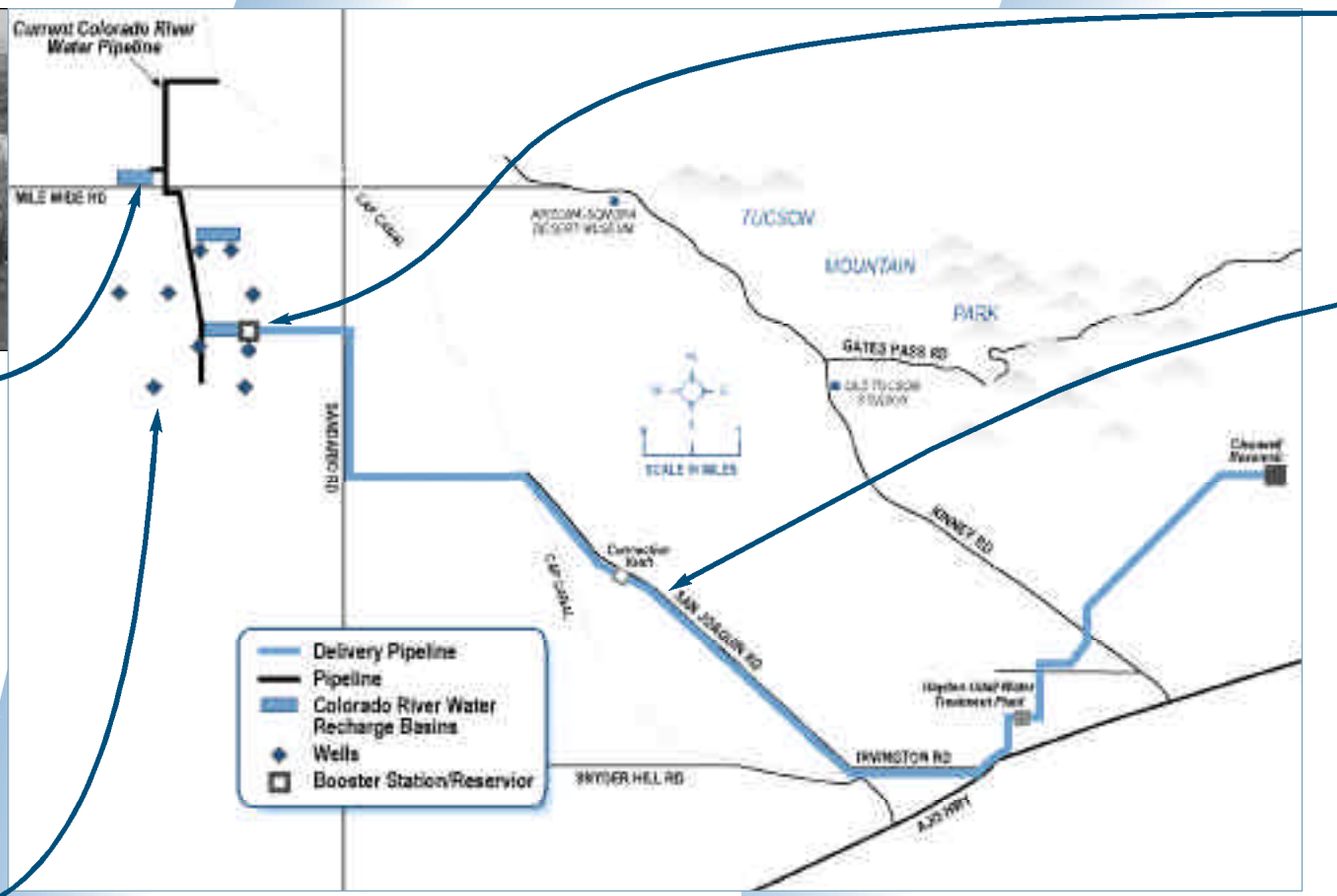
From Avra Valley To You – How Clearwater Works

Recharge Basins

Recharge is the way in which the Clearwater Facility will create our blended water and store it underground for future use. Colorado River water from the Central Arizona Project canal flows through a pipeline to specially constructed recharge basins. The water then soaks into the ground and, over time, reaches the water table where it slowly blends with the native groundwater. There are currently three recharge basins at Clearwater recharging about 5 billion gallons of Colorado River water annually. During the next few years, additional basins will be constructed to put more of Tucson's allocation of Colorado River water to work for us.

Wells

Water wells drilled 1,000 feet deep recover the blended water from around the recharge basins. Nine wells will operate initially, but more will be added over the next two years. These wells are connected to the Clearwater Reservoir by nearly 11 miles of collector pipelines.



The Clearwater Renewable Resource Facility will create and deliver to Tucson Water customers a blend of recharged Colorado River water and native groundwater. The Facility is made up of several components.

Reservoir and Booster Station

Water is delivered from the wells to this 8.5 million gallon covered water reservoir where it is stored. The booster pumps, capable of pumping 54 million gallons a day, and located just to the south of the reservoir, then pump it into the Clearwater pipeline.

Pipelines

Eleven more miles of pipeline are needed to carry blended water from the reservoir to the pumps at the Hayden-Udall Water Treatment Facility. This pipeline ranges from 60″ to 72″ in diameter and can carry much more water than will be initially delivered from Clearwater. Planning for the future in this way allows Tucson Water to increase the recharge of Colorado River water and the recovery and delivery of blended water during the next few years.

Hayden-Udall Water Treatment Facility & Pumping Plant

Blended water will be pumped through a portion of the Treatment Facility where chlorine will be added to keep the water safe. Sodium hydroxide may also be added to balance the pH. The pH will be balanced gradually so that the change will have a minimal impact on Tucson's water distribution system. When the blended water is ready to leave the treatment facility, the Central Arizona Water Conservation District's Snyder Hill Pumping Plant will boost it through the Tucson Mountains to Tucson Water's Clearwell Reservoir near Starr Pass. From there, it is added to the City of Tucson's Water Distribution System.

– Replacing Mains

Rebuilding Our Water System

In 1994, Tucson Water began an accelerated program to replace or rehabilitate more than 225 miles of old water mains throughout the water distribution system, many dating from the 1940s or before.

Today, nearly 98% of our old, galvanized steel water mains have been replaced with modern piping.In addition,43 miles of cast iron mains have been lined and rehabilitated.

These new pipes will help ensure that Tucsonans will not experience any water quality problems related to corroded water mains,such as those which occurred in the early 1990s.

Where the blend will go…

Blended water moves from the central Avra Valley to the Hayden-Udall Water Treatment Plant where it is pumped through the Tucson Mountains to the Starr Pass Reservoir, west of the City. A small part of the blend will be delivered to neighborhoods near the Tucson Mountains. Most of the water flows by gravity to Tucson Water's major water distribution center in the central part of Tucson.

The blend is added to the citywide water distribution system where it mixes with the groundwater already in our water mains. It will generally flow as shown on this map, but the season of the year and variations in customer water use throughout the city will cause the distribution of blended water to vary. For example, excessive demand for water in a certain geographic area can "pull" more of the blended water into that area of the system.

By 2004, when more than 54 million gallons a day of blended water are entering the water distribution system, most Tucson Water customers will be receiving at least some of the blend.

Blending the Blend

Blended water from Clearwater blends with water from the South Avra Valley wellfield. This combined water then mixes again with water from the South Side Wellfield and remediated groundwater from the Tucson Airport Remediation Plant. It then flows to the central Tucson area where it mixes with water from the Santa Cruz wellfield and adjacent wells in the Central Wellfield.

Problems Like the Early 1990s?

Here's Why It Won't Happen

The scientific research and customer discussions of the past several years and the ultimate design and operation of the Clearwater Facility have all been done to make sure that the problems of colored water, taste, and odor that occurred in the early 1990s will not be experienced again by our customers. Some of the differences between the delivery of CAP water and the delivery of blended water from Clearwater are explained here.

Gradual Introduction

The blended water will be introduced to the water distribution system gradually over a period of years, and will be re-blended repeatedly with groundwater from other wellfields while it is in the water system.

Direction of Flow

The direction of flow of the blended water through the water distribution system will match the current direction of groundwater flow. In the early 1990s flow reversals in mains contributed to the problems of water quality.

Pressure

The pressure of the blended water through the water distribution system will match the current pressure of groundwater in the system. Changes in pressure also contributed to problems of the early 1990s.

Demonstration in Neighborhoods

During 1999 and 2000, Tucson Water delivered the Clearwater Blend to four volunteer Tucson neighborhoods for 90 days each. The demonstrations were closely monitored and the homes inspected before and after the delivery. No problems occurred with plumbing or appliances and many volunteers said they preferred the taste of the blend over the groundwater they had been receiving before the demonstrations began.

pH

Corrosion studies conducted by scientists as part of the *At The Tap* program determined that relative pH (acid balance) is the most critical factor in preventing corrosion problems in the water mains and metallic plumbing. To prevent corrosion, Tucson Water is prepared to adjust the pH of the water slowly if any signs of corrosion are detected in the water system.

Main Replacement

Tucson Water has replaced or refurbished more than 225 miles of old, rusted water mains throughout the water distribution system. These corroded mains contributed greatly to the colored water, taste, and odor issues of the early 1990s.

What Clearwater Means for You, the Tucson Water Customer

What to Expect From the Blend

The Clearwater wells pull water from deep beneath the surface of the existing water table in Avra Valley. Based on the depth of the wells and other hydrological information, Tucson Water hydrologists are confident that it will take years before recharged Colorado River water mixes enough with the groundwater to significantly change the water quality. This very slow blending process and the fact that the Clearwater Blend will also be mixing with groundwater from Tucson Water's other wellfields means that, for the most part, you should see little change in the water you receive for a number of years.

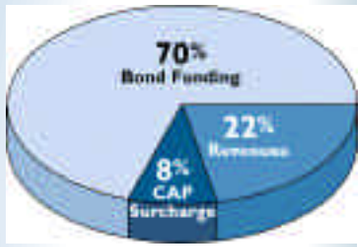
Keeping Your New Water Safe

All drinking water in the United States is disinfected before delivery and must meet a large number of state and federal standards at all times. In Tucson, as in many other communities, a small amount of chlorine is added to the water. Federal regulations require that there be at least 0.2 parts per million of chlorine at the point where water enters the distribution system and that a detectable amount of chlorine be found throughout the water distribution system.

Tucson Water chemists work daily to ensure all the water we deliver meets or is better than all U.S. Environmental Protection Agency and Arizona Department of Environmental Quality standards for drinking water safety. We report the results of chlorine level measurement to you, as well as other standards for the blend, through bill inserts, newsletters, the Tucson Water web site, and on our Water Quality Information phone line 791-4227.

Paying for Clearwater

As with most large public works projects, the cost of the Clearwater Facility is considerable – about $75 million for the initial construction.This cost is being paid primarily through water bonds, approved by voters in 1994 and 2000. Other funds come from Tucson Water's operating revenues and from the CAP surcharge that has been included on all customer bills since the mid-1980s.



Note: These percentages are subject to change depending on annual revenue recovery, bond ratings and the bond market, and other factors.

Saving our Central Wellfield

Bringing 18 million gallons of water to Tucson from a renewable water resource will allow us to reduce our groundwater pumping in the central part of the City.

The water table in the Santa Cruz Valley was built up over millions of years by the natural seepage of rain and snowmelt runoff into the porous soils deep underground. Many years ago, the water table in Tucson was so high that water was present in the Santa Cruz and Rillito Rivers. But the beginning of groundwater pumping in the early part of this century began to lower the water table. Increased population and more pumping to supply water to these citizens caused the ancient water table to drop. Today it has dropped as much as 250 feet under some areas of central Tucson.

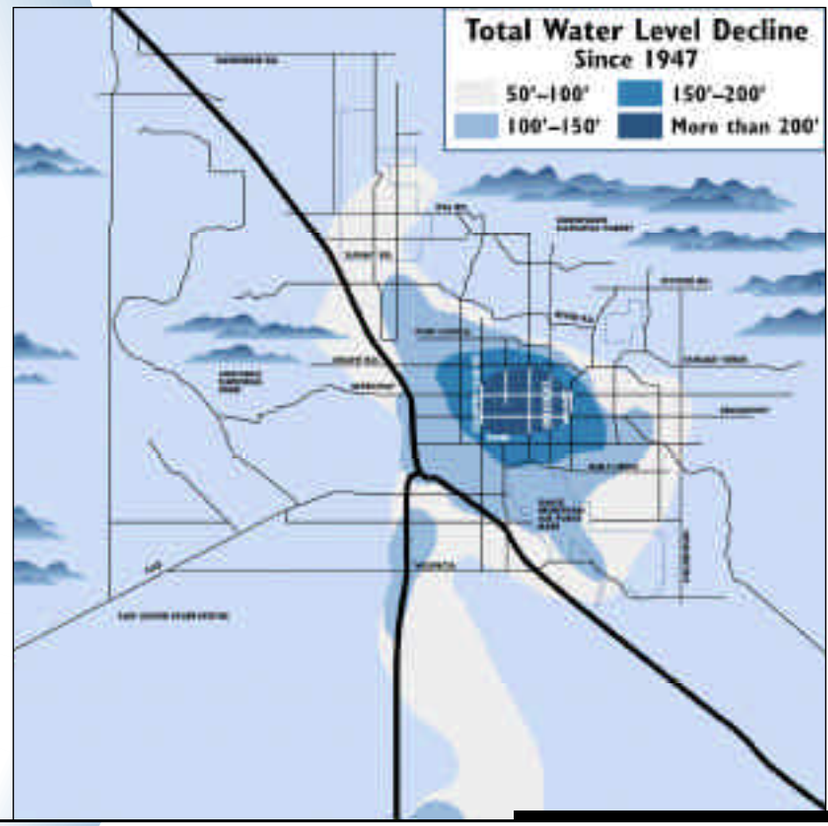
This dramatic change in the water table has grave consequences for our City and our environment – riparian areas along our rivers and arroyos disappear, subsidence (the collapse of the earth above areas where the water has been removed) becomes a threat, and the water table can become permanently damaged, unable to accept and hold water in the future.

Shutting Down Wells in Central Tucson

Adding water from the Clearwater Facility to our water supply will allow us to shut down most of the wells in central Tucson where these problems are the greatest. These wells in the Central Wellfield may still be required to provide some water to meet summer peak demand, and must be kept available in case of a water supply outage elsewhere in the water production system. However, for the most part, groundwater pumping in these areas will cease, allowing our water table to begin to be replenished by nature.

Wells selected for shut-down will be based on the following priorities –

- Wells located in areas of Tucson where the water table has dropped the farthest.



- Wells where there are water quality issues. For example, wells that pump very hard water and those that pump sand or air with the water.
- Wells located in areas close to groundwater contamination.
- Wells that have low pumping efficiency and therefore, a higher energy cost for pumping.

TDS and Taste

In taste tests, Tucson Water customers preferred a blend of water with TDS (total dissolved solids) in the range of 350 – 450 parts per million. Although there are no health-based water quality standards for TDS in water, Tucson Water has committed to this range as a maximum for TDS in the blend being delivered from Clearwater. The amount of TDS in the blend will not exceed 450 parts per million for the forseeable future.

Colorado River water has a higher content of TDS than most groundwater in southern Arizona. So, as the Colorado River water reaches the water table beneath the Clearwater recharge basins and its percentage in the blend increases, the TDS will begin to rise. This change may take many years, but when the levels of TDS begin to approach our targeted maximum levels, Tucson Water will further blend the water with groundwater from the South Avra Valley wellfield. This additional groundwater will be added to the blend through a pipeline from the southern Avra Valley wellfield that connects to the Clearwater pipeline. The interconnect is located at about the mid-point on the Clearwater line – between the recharge area and the Hayden-Udall Treatment Facility.

What is TDS?

Total Dissolved Solids (TDS) is a measurement of the mineral content in water. Mineral content can often affect the taste of the water and many people can detect a salty taste when TDS is above 500 parts per million.High TDS levels are also responsible for water spotting on dishes and plumbing fixtures and for the white mineral buildup sometimes seen on water faucets and swamp coolers.

What's a part per million?

Substances in water are often measured in very small units. Many of the dissolved minerals such as sodium and calcium monitored by Tucson Water are measured in terms of parts per million. To help you visualize how very small this unit is, we offer the following illustrations.

One part per million is the same as:

- 2 (two) ounces of water in a typical 15,000 gallon backyard swimming pool
- One second of time in 11.6 days

Running dry –

The need to use our renewable water resources

Tucson is pumping groundwater 2 1/2 to 3 times faster than it can be replaced by nature and has been for many years. We clearly need to utilize our renewable water resources to meet current and future water demand.

Renewable water resources are just that – renewable. Reclaimed water (treated wastewater) and Colorado River water delivered by the Central Arizona Project are constantly renewed, unlike our groundwater which has built up in the water table over millions of years and is slowly replaced by nature. In addition to these renewable water resources available to us, Tucson Water includes water conservation in this category, because learning to save water helps extend all our water resources.

Reclaimed Water

In Tucson, we produce more than 60 million gallons of wastewater each day. After being treated by Pima County, much of this water is discharged into the Santa Cruz River. However, Tucson Water takes a portion of this wastewater and treats it to higher standards to create **reclaimed water**. We operate an 85-mile-long reclaimed water system, separate from the drinking water system, that carries this reclaimed wastewater to all city golf courses, many parks and playgrounds, schoolyards, and city street medians to save drinking water. Funds from voter-approved Water Revenue Bonds will be used to make reclaimed water available to other customers in the metropolitan area.

Colorado River Water

The City of Tucson currently has a contract to purchase more than 45 billion gallons of Colorado River water each year from the Central Arizona Project (CAP). The CAP brings water to Tucson through a 335-mile canal from Lake Havasu on the California border. Because the Colorado River flows year-round, it is another, very important renewable water resource.

Ensuring Your Water is Safe

Water Quality Monitoring

Monitoring of water quality is a very important part of the delivery of blended water.

Tucson Water's primary water quality goal is to protect the health and safety of our customers. To accomplish this, Tucson Water thoroughly tests the water for microbiological, organic, and inorganic contaminants that may affect the health of water users.

To meet this goal with water from the Clearwater Facility, Tucson Water will monitor the water quality of the blend –

- At 11 monitor wells near the recharge basins
- At each of the recovery wells where blended water is pumped from the ground
- At the point where the blend enters the Hayden-Udall Water Treatment Facility
- At the point where it leaves the Hayden-Udall Facility
- At 257 monitoring points in the water distribution system

Over the next few years, an additional 22 monitoring stations will be installed to collect "real-time" water quality data and transmit it on a daily basis directly to Tucson Water's Internet site (**www.ci.tucson.az.us/water**) where it will be available to the public. The quality constituents being reported in real-time were selected by asking Tucson Water customers what information they would like to know.

The results of this testing are reported to customers each month in their water bill. Customers can also get this information by calling the Water Quality Information Line at 791-4227.

Find Water Quality Information from Tucson Water At…

- Water Quality Information Phone Line – **791-4227**
- Internet Web Site – **www.ci.tucson.az.us/water**
- ***Your Water Connection*** – Newsletter each month in your water bill

You Already Know the Blend

The delivery of blended water to supplement our water supply is not a new idea

During the past several years, Tucson Water has made it a priority to talk with customers about the concept of the blend and to offer information and free samples of this new water. Most Tucson Water customers already have some knowledge of our blended water and may have had a chance to taste it for themselves.

Doing the Research *At The Tap*

The blend of recharged Colorado River water and groundwater was developed over several years beginning in 1997. That's when

Tucson Water started *At The Tap*, a program focused on water quality in the customer's home. The program included scientific research on Colorado River water and a great deal of communication between Tucson Water and its customers. A water quality telephone line was established and Tucson Water began printing water quality information in its monthly bill insert.

Scientific studies and testing were conducted on pipes removed from Tucson's water system to determine the corrosive effects on them of various water qualities.

More than 100 customers participated in taste tests as part of *At The Tap* and tasted and evaluated water of various qualities. A majority of customers preferred a blend of groundwater and Colorado River water with a range of total dissolved solids between 350 and 450 parts per million. That range is now Tucson Water's target for blended water quality, and the Clearwater Facility was designed to deliver water that can be maintained in that range.

The Ambassador Neighborhoods Program

In 1999, after the completion of the *At The Tap* research on Colorado River water, Tucson Water began a demonstration project to prove that the blend would be acceptable to its customers.

Volunteer neighborhoods were sought to take part in the demonstration, which came to be called the Ambassador Neighborhoods Program. More than 650 volunteers stepped forward and four neighborhoods were selected to take part. Neighborhoods were specifically chosen based on water use history, location, and home type to be as representative as possible of Tucson Water's customers. Neighbors on North Alandale Place, East 4th Street, West Michigan Street, and West Bopp Road were taken off the City's groundwater system and used blended water for 90 days.

Customers reported no problems with plumbing or appliances. Many of them said they liked the taste of the blend better than the groundwater they were receiving before the project started. Tucson Water continually monitored the water quality and inspected appliances and swamp coolers in the neighborhoods. The results of that monitoring showed no adverse effects.

The Ambassador Neighborhoods Program ended in September of 2000. The results of the Program show that this blend of recharged Colorado River water and groundwater can be used successfully in Tucson's homes and businesses.

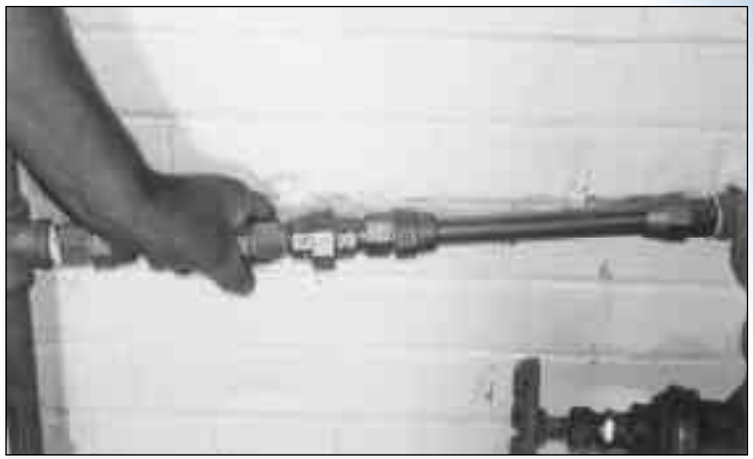
What Tucson Water Learned from Neighborhood Blended Water Demonstrations

Two of the major reasons for conducting the Ambassador Neighborhoods Program were to prove the blended water would not have any adverse effects on customers homes and to see how the families would like using the water. A total of 51 homes in four neighborhoods participated in the demonstration. The homes in each neighborhood were inspected before the start of the demonstration, monitored throughout the 90-day period of blended water use, and inspected again following the completion of the demonstration. Here are some of the conclusions from this thorough investigation into the use of blended water in neighborhoods.

- Residents reported the water was of good quality. Many of them strongly preferred it to the groundwater they had been receiving prior to the demonstration.
- There were no observed impacts on household plumbing or appliances.

- Special studies were conducted on evaporative coolers. There are no apparent differences in the operation of coolers using blended water as opposed to groundwater.
- Using the blend in dishwashers resulted in negligible spotting on glassware.

- In several homes, dissimilar metals were found connected in the plumbing. Connected pipes made of different metals (for example, copper attached to iron pipes) can cause corrosion no matter what type of water is flowing through them. Customers who have these types of water pipe connections should replace them.



The Bottled Blend

Doing Your Own Taste Test

During 1999 and 2000 Tucson Water put the same blended water that was being demonstrated in our Ambassador Neighborhoods into 20-ounce plastic bottles and distributed it to customers across Tucson. Bottling the blend soon became one of the most popular ways for customers to learn what blended water was like. More than 1 million bottles were provided at special events. Tucson Water did this so that as many customers as possible would have a chance to taste the blend before it was added to our water system.

Does Clearwater Mean The End of Our Water Concerns?

Getting the Clearwater Facility up and running is a tremendous step forward in making sure Tucson Water customers have clean, quality water for the future. Eventually, more than half of our water will come from Clearwater. But this project does not mean the end of the need for water conservation and it will not solve all of Tucson's water issues.

Water Conservation

Yes, we still live in a desert and will still need to conserve water. Conserving is especially important during the hot summer months when water use is at its peak. Conservation also lets us keep our wells in the Central Wellfield shut down so that nature can continue to refill our groundwater.

Landscaping with native plants, using a broom to clean your driveway instead of the hose, and running the dishwasher or washing machine only with full loads are just a few of the many ways you can save water. Don't forget, saving water also lowers your water bill! For more tips on saving water, visit Tucson Water's web site at **www.ci.tucson.az.us/water** or call the Water Conservation Office at 791-4556.

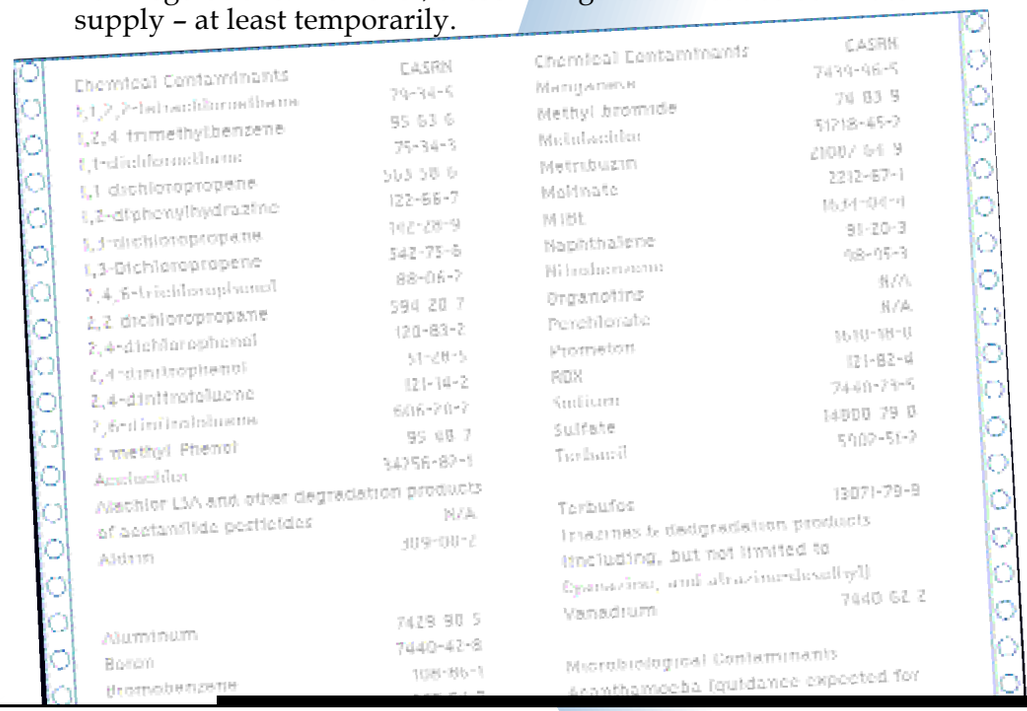
TUCSON WATER Tanjero PROGRAM

Groundwater Contamination

Groundwater contamination, primarily from old landfills or industrial activity, has become a serious problem in some areas of Tucson. Tucson Water has shut down a number of wells in the city for this reason and others may need to be turned off in the future. These are water resources that are lost to us for the foreseeable future.

New Water Quality Regulations

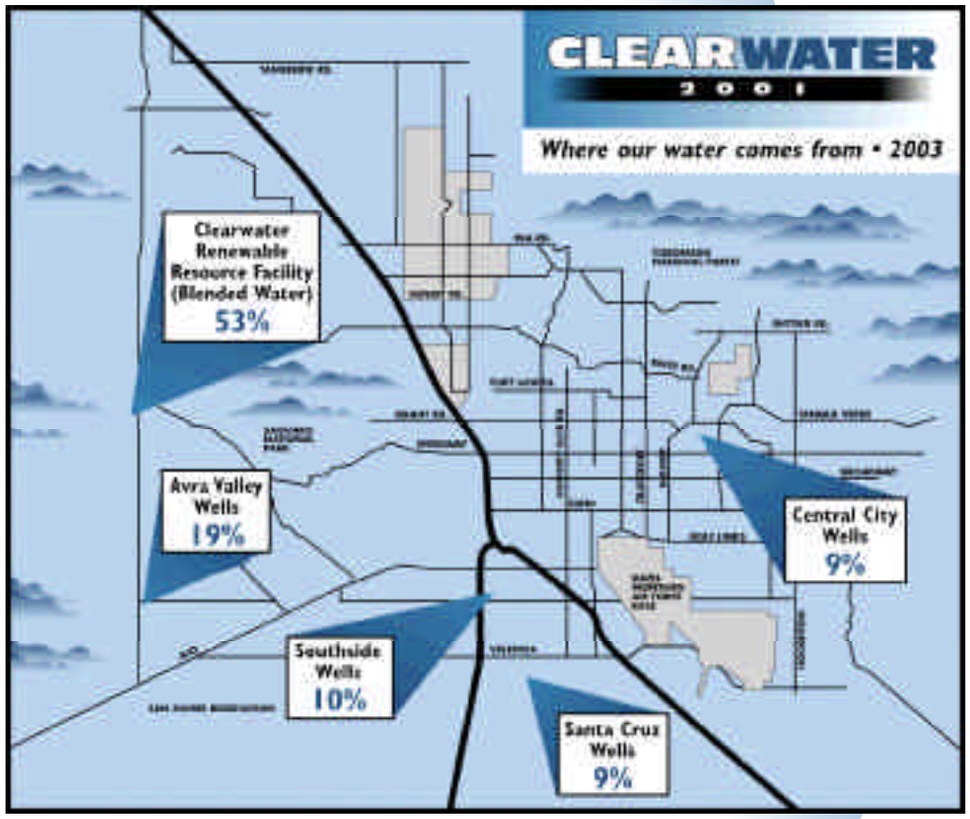
Drinking water quality in Tucson and all over the United States is regulated by the U. S. Environmental Protection Agency. This agency is proposing new regulations, likely to be finalized in the near future, for the permitted levels of radon, arsenic, and other substances in drinking water. Many of Tucson Water's wells could be effected by one or more of these new regulations. How Tucson Water eventually meets these new standards and the cost of the selected treatment processes has yet to be determined. The EPA will allow water utilities several years to comply with the new regulations. However, these rulings could reduce our water supply – at least temporarily.



Into the 21st Century -

Completing Clearwater

The construction of the Clearwater Facility will not end with the initial delivery of blended water to Tucson. More work will take place at Clearwater during the next few years as the project is expanded to include additional recharge basins and wells. By 2003, a total of eleven basins will be recharging up to 60,000 acre-feet (19.5 billion gallons) of Colorado River water each year. About 16 additional wells also will be drilled and completed in the recharge area to recover more of this water. Eventually, more than half of Tucson's water (53%) will be delivered from the Clearwater Facility.



Thank You To Our Customer Volunteers

The completion of the Clearwater Facility and the delivery of this vital, renewable source of water to our community would not have been possible without the contributions of many Tucson Water customers. These citizens stepped forward to participate in the *At The Tap* Program, the water taste and preference panels, and the demonstrations of blended water in Ambassador neighborhoods. The willingness with which these customers gave of their time should be commended. Their assistance helped immeasurably in developing solutions to Tucson's water issues. We want to thank them all.

Tucson Water would like to thank our customers throughout the metropolitan Tucson area for their participation and cooperation in helping us bring the new Clearwater resource to our community. We have had support, constructive criticism, volunteerism, healthy skepticism, advice and much more from our customers and we appreciate it all.

Hundreds of people at Tucson Water and in other departments of the City of Tucson have worked for years to make it possible for us to conceive of, design, build and operate the Clearwater Renewable Resource Facility and we would also like to thank them for their hard work.

At the same time, we have also worked hard to keep you, our customers, informed about your water supplies and water quality and to make sure you have full and open access to whatever information you want about your water. Through the efforts of the past few years, we hope that we have built confidence with you and that you feel the quality of your water reflects the job you have directed us to do. Thank you for working together with us to ensure Tucson has a reliable supply of quality water for the future. We will continue to work with you to keep and improve your confidence in us and to make sure the water you receive meets all standards, including yours.

David V. Modeer
Director

– and the 593 employees of Tucson Water

Learn More!

For More Information About Clearwater 2001
and other local water issues

- If you have questions about the construction of the Clearwater Renewable Resource Facility in Avra Valley, please call the Project Hotline – 885-8010.
- If you have questions about the new Tucson Water – the blend being naturally created at Clearwater, please call Tucson Water's Public Information Office – 791-4331.
- It takes a team to Beat The Peak. For information about how you can conserve water and lower your water bill, call Tucson Water's Water Conservation Office – 791-4556.
- Customers can also send their questions or comments to Tucson Water by email at **tw_web1@ci.tucson.az.us** or by writing to Tucson Water, Public Information Office, P.O. Box 27210 Tucson, AZ 85726-7210.
- City of Tucson TTY number (520) 791-2639.
- For general water information contact the Arizona Department of Water Resources at 628-6758 or on the web at **www.water.az.gov/**.
- For water quality regulation information call the Safe Drinking Water Hotline at 1-800-426-4791 or on the web at **www.epa.gov/safewater**.
- Para recibir este documento escrito en español, sírvase llamar al 791-4331.